

# THE WEATHER AND CIRCULATION OF APRIL 1969

## A Warm Month Accompanied by Severe Flooding in the Upper Midwest and Increased Westerlies

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### 1. MEAN CIRCULATION

The 700-mb circulation for April 1969 was characterized by long waves of small amplitude and by unusually fast middle-latitude westerlies (fig. 1). The temperate-latitude zonal index over the western portion of the Northern Hemisphere was  $10.5 \text{ m sec}^{-1}$  or  $2.5 \text{ m sec}^{-1}$  above the April normal. This was the highest value of this monthly index since mid-November to mid-December of 1968 when it was  $12.2 \text{ m sec}^{-1}$  or  $1.4 \text{ m sec}^{-1}$  above normal. Since then, the index has been below normal. As the mid-latitude westerlies increased, the subtropical westerlies decreased rapidly to below normal from speeds that had

been above normal since the fall of 1968. A comparison of zonal wind speed profiles for March and April (fig. 2) shows the pronounced northward displacement of the 700-mb westerlies, their increase in middle latitudes, and decrease in lower latitudes. This shift in position of the major wind belts was related primarily to loss of blocking over the Atlantic and eastern Canada where it has been a prominent feature of the circulation since early winter.

The distribution of the 700-mb height anomaly in April (fig. 3) implies fast westerly flow over much of the Northern Hemisphere. Outstanding features are the three strong negative anomaly centers located in the Gulf of Alaska, the northern Atlantic, and over northern

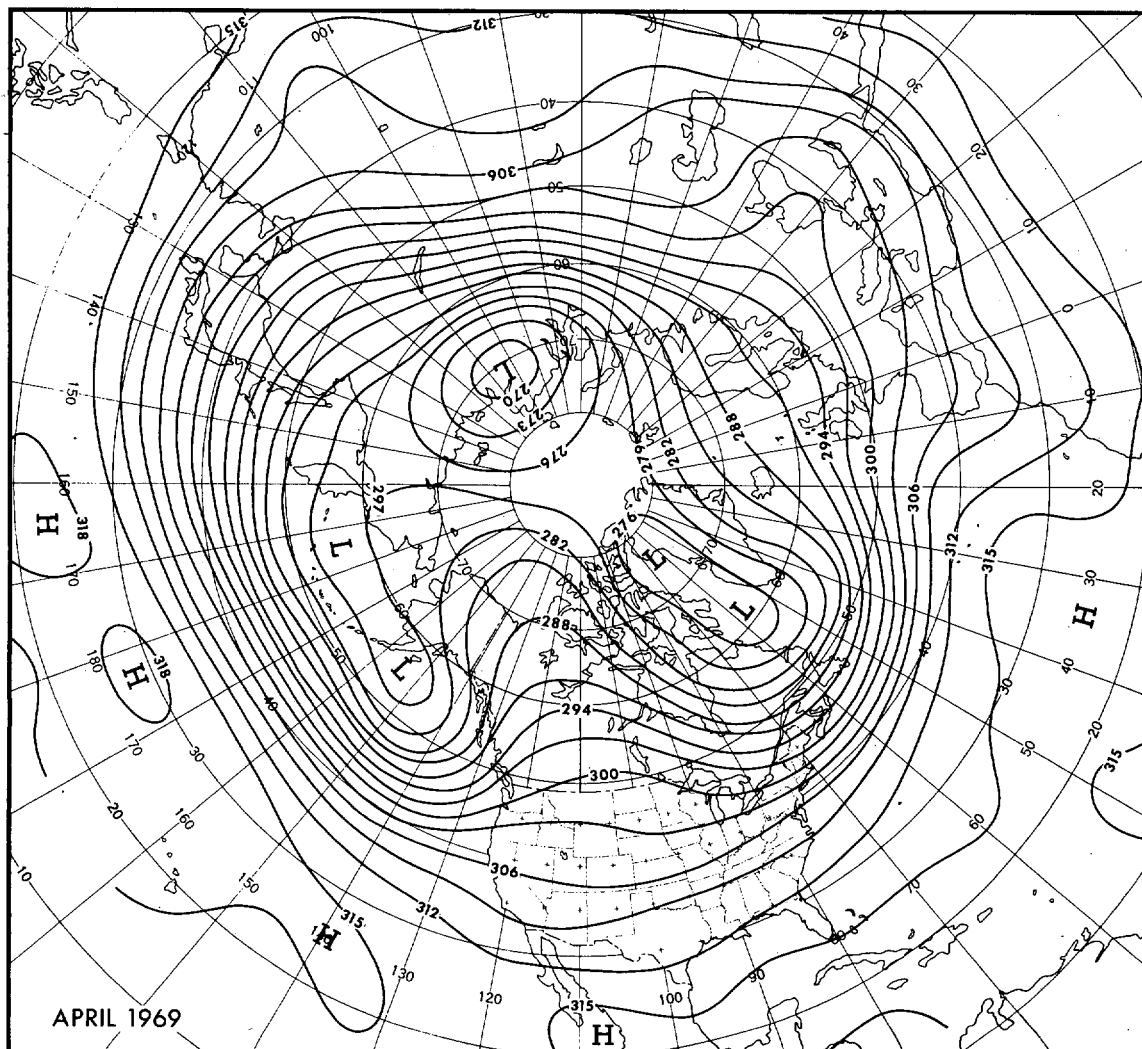


FIGURE 1.—Mean 700-mb contours (decameters) for April 1969.



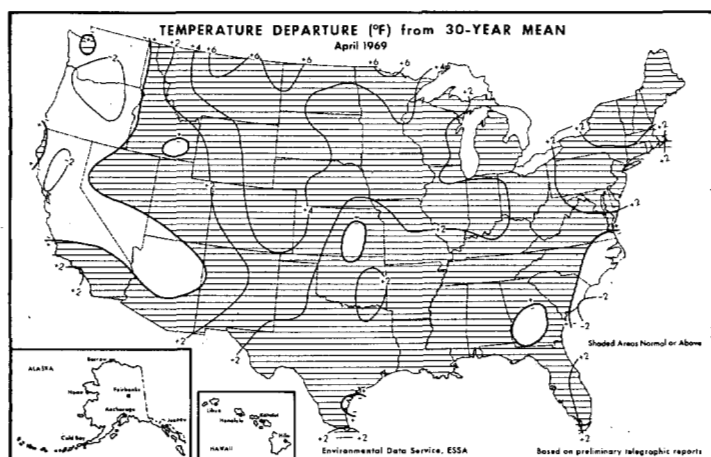


FIGURE 5.—Departure from normal of average surface temperature (°F) for April 1969 (from Environmental Data Service, 1969).

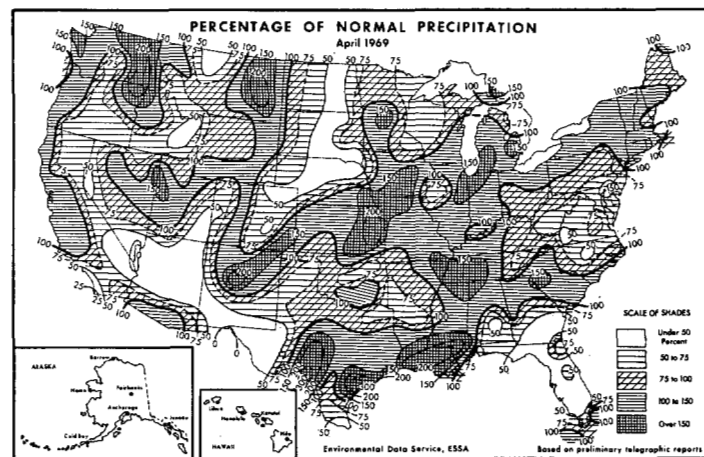


FIGURE 6.—Percentage of normal precipitation for April 1969 (from Environmental Data Service, 1969).

It was also wetter than usual (fig. 6), particularly along the coast with more than 8 in. of rain falling in western Washington. Cool, wet conditions here were associated with the eastern Pacific trough (figs. 1, 3) and with frequent short waves and fronts which moved into the West.

Elsewhere over the Nation, the pattern of precipitation was quite irregular (fig. 6) and not too well related to the large-scale circulation. In general, precipitation exceeded normal over most of the Southern Plains, Central States, and Northeast, with amounts of 8 in. or more in parts of the Tennessee and Lower Mississippi Valleys. Heavy rains were related to the mean trough in the Southern Plains and to the broad area of cyclonic flow that extended from there to the Northeast (fig. 1). Southeasterly 700-mb anomalous flow (fig. 3) also suggests more than normal precipitation in much of this area. Notably dry regions were most of Florida, central portions of the Dakotas and Nebraska, and parts of the Far Southwest. No measurable precipitation fell at Las Vegas, Nev., or El Paso, Tex.

### 3. UPPER MIDWEST FLOODS

Probably the most noteworthy weather item of April was the severe flooding in the Upper Midwest. Because of the unusually heavy winter snows here, the flood potential had been recognized many weeks before. During the second week of April, melting of this snow was accelerated by rapid warming and heavy rains in some areas. The situation near midmonth can best be summarized by quoting the article prepared by the Office of Hydrology, Weather Bureau, ESSA, that appeared in the *Weekly Weather and Crop Bulletin* (Environmental Data Service, 1969):

"Serious flooding is occurring throughout many areas of the Upper Midwest as melting of the excessive snow-pack which accumulated during the past winter takes place. Record flood crests were observed on the James and Big Sioux Rivers, and flood crests approached those of 1962 on other tributaries of the Missouri River in South Dakota and Iowa, forcing the evacuation of several thousand people.

"In the headwaters of the Des Moines River, the West Fork of the Des Moines crested at 19.5 feet at Jackson, Minn., 1 foot higher than the previous record flood which occurred in 1965. The Minnesota River is approaching a record crest at Montevideo, Minn. Downstream, the Minnesota River is not expected to exceed the record levels of 1965 but is well above the flood crests of 1952. Serious flooding continues on the Souris River around Minot, N. Dak., where 4,000 persons have been evacuated. The Red River of the North is approaching a crest which is higher than any flood since 1897. The main stem of the Upper Mississippi is not expected to exceed the record levels of 1965 but should crest well above the flood stages of 1952."

The Mississippi River at St. Louis was above flood stage on the 21st, 22d, and 23d, cresting at 31.1 ft on the 22d. As April ended, extensive lowland areas, especially along the James River, were still under water.

### 4. VARIABILITY WITHIN THE MONTH

Considerable warming occurred across the Nation during the first half of April as the ridge that had been along the Pacific coast of Canada in March moved well inland. Temperatures averaged 16° to 23°F warmer during the first week as compared to the previous week in parts of the Northern and Central Plains States. Widespread sunshine accompanied the springlike warmth along with generally scattered shower activity. A Low moving in from the Pacific on the 5th spread moderate to heavy amounts of precipitation across much of the Nation, except in the Southwest where it was dry. The cold front with this system was accompanied by winds of 71 mi hr<sup>-1</sup> at Winslow, Ariz., on the 6th and 60 mi hr<sup>-1</sup> at Pueblo, Colo., on the 7th. The storm also brought the first tornadoes of the season to Missouri, with others in Oklahoma. Severe weather conditions prevailed in southern Texas and the Lower Mississippi Valley on the weekend of the 12th and 13th as an upper Low moved across the Southwest.

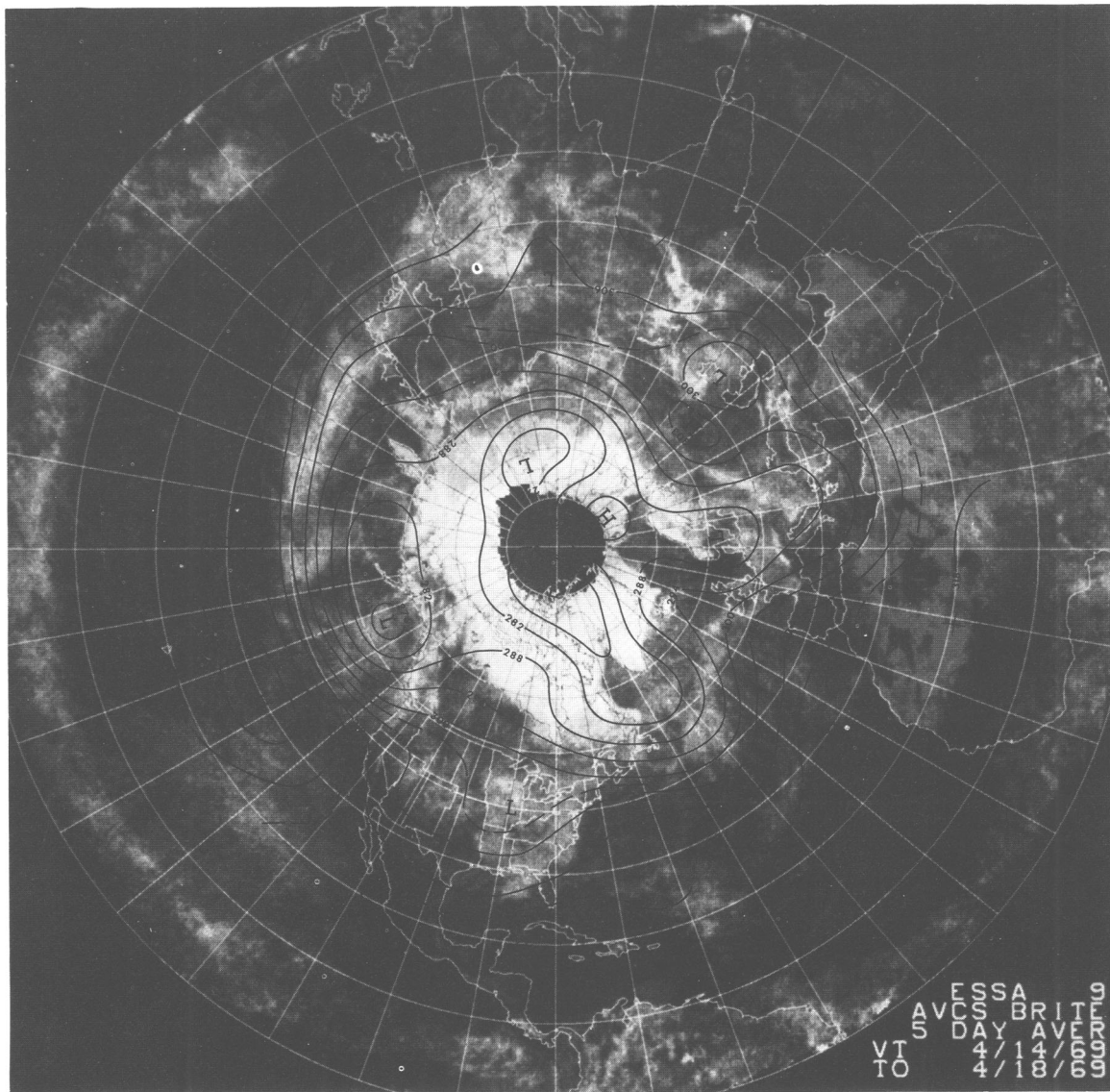


FIGURE 7.—Mean 700-mb contours (decameters) for Apr. 15–19, 1969, superimposed upon a mean brightness composite photograph of daily observations from the ESSA-9 satellite for Apr. 14–18, 1969.

The trough which had been near the west coast during the first half of the month progressed to the middle of the Nation during the last half, resulting in cooling most areas and temperatures below normal in the Southern States and Far West. The mean 700-mb circulation for April 15–19, shown in figure 7, can also be considered representative of the flow for the last half of the month over North America and the Pacific. The contours have been superimposed upon the average brightness of the Northern Hemisphere as measured by the ESSA-9 satellite for nearly the same 5-day period. There was good correspondence between the bright areas over the United States and widespread heavy precipitation that occurred. The darker areas in the Northern Plains, California, Southwest, and Florida are also closely related to the lack of cloudiness and to the dryness that was observed in those regions. Across Canada, the sharp contrast between the bright and dark areas delineates the boundary of the snow cover. Also of interest is the bright area across the Pacific that corresponds to storminess associated with the jet axis. Note how the mean brightness increases

where cyclonic activity is concentrated in the Gulf of Alaska and in the trough over the Atlantic.

Several periods of locally severe weather, mostly in the Great Plains and Central States, highlighted conditions during the last half of April. Moreover, a late season storm brought moderate to heavy snow to parts of the Northern Rockies and Northern Great Plains late in the month. Nine inches of snow fell at Duluth, Minn., on the 27th. After this storm, temperatures fell to near or below freezing as far south as northern New Mexico and the Texas Panhandle—some cities, including Albuquerque, N. Mex., Moline, Ill., and Cleveland, Ohio, established new daily minimum temperature records.

#### REFERENCES

- Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, Vol. 56, Nos. 15 and 19, Apr. 14 and May 12, 1969.  
 Posey, J. W., "The Weather and Circulation of March 1969—A Very Cold Month With a Developing Flood Threat in the Upper Midwest," *Monthly Weather Review*, Vol. 97, No. 6, June 1969, pp. 464–470.